METRE AND TAL IN NORTH INDIAN MUSIC

Martin Clayton

This paper first appeared in French under the title, "Le metre et le tal dans la musique de l'Inde du Nord" in *Cahiers de Musiques Traditionelles* 10 (1997), pp.169-189. Translated by Georges Goormaghtigh. ISBN 2-8257-0579-9. The English version is published here by permission.

Abstract

This paper discusses the relationship between the concept of tal in North Indian (Hindustani) music, and that of metre in Western music and in ethnomusicology, drawing together strands of research from several different branches of music studies. What do we mean by metre, what is tal, and to what extent do the two concepts overlap? Can studies in musicology, ethnomusicology and music psychology provide insights into Indian music, and can the study of tal contribute to an understanding of metre as a widespread musical phenomenon? Besides discussing some of the theoretical issues generated by such questions, this paper also provides some concrete illustrations of the benefits of interdisciplinarity and methodical comparison.

Introduction

North Indian (Hindustani) art music has a sophisticated theory of metre, known as tal, which can be traced back through a series of musicological treatises over a period of approximately 2,000 years of continuous development. This theory describes the temporal organisation of all metrically bound (nibaddh) music belonging to the North Indian classical tradition: the South Indian or Carnatic tradition has its own related tal system, which diverged from that of the North around 300-400 years ago. The relationship between the theory and the practice of this music is, unsurprisingly perhaps, complex, and is considered in some detail in an earlier work. (1) This paper uses some of the findings of that study - which describes the practice of tal in the terms of its theory, rather than simply describing the theory itself - in order to discuss tal in the context of other musics and of ethnomusicological theories of rhythm and metre.

This paper has two complementary aims: firstly to investigate what, if anything, musicological and psychological theories originating outside Indian music studies may add to the understanding of tal; and secondly to consider what the study of tal may contribute to the development of general theories of rhythm and metre within ethnomusicology. (2) We will see that some features of tal may be described in terms of general theories, since they appear to correlate to similar features of other metric systems. Other features are rarer, and possibly unique to North Indian music: this should not surprise us, since each metric system may in some sense represent a special case.

Behind these specific aims lie broader questions. Might it be possible, by pulling together data and analysis from many different music cultures, to develop generally applicable theories of rhythm and metre, according to which each individual system, although seen as a special case,

is shown to have basic features explicable in general terms? Could each rhythmic system be described in terms of parameters founded on psycho-physiological universals, with limits for each parameter determined locally? Or is musical rhythm's boundless diversity beyond the reach of such general or comparative study? If the latter is the case (and many will assume so, unless and until the contrary can be demonstrated) then how can we objectively define rhythmic terms such as syncopation, polyrhythm and polymetre, even perhaps tempo, metre and rhythm itself? How can we employ Western terms and concepts in the rhythmic analysis and transcription of non-Western musics, without being misled by such ethnocentrism?

If we are to study musical rhythm in any depth, and we believe there are many reasons why we should do so, then a reconstruction of rhythmic theory from first principles is necessary, a reconstruction which (it may be hoped) will generate objectively definable rhythmic parameters and concepts with which to conduct a wide range of studies. Without these tools we will be overwhelmed by a mountain of data we are unable to analyse with any degree of reliability, and rhythmic analysis will remain as underdeveloped and underused as it has always been in ethnomusicology. As will become apparent, we believe that various theories and observations generated by research in the field of cognitive psychology will also be of use in this discussion: in this respect this paper could be said to fall within the bounds of cognitive ethnomusicology.

This paper will address a small part of this problem. It will first of all outline some of the most important metrical theories of use to ethnomusicologists, and then with this in mind discuss tal in North Indian music, and the implications of tal for ethnomusicology and vice versa.

Metre: an ethnomusicological perspective

Metre, along with tempo and rhythm itself, is one of the core concepts we use to describe rhythmic phenomena. But what is metre? To many, particularly those familiar with staff notation, it is simply the dimension of music which is represented by the time signature. A time signature has two components, one describing the number of beats forming each measure and the other indicating which sign is used to notate this 'beat'. The time signature thus indicates both that a particular time unit is specified as a 'beat', (3) and that a defined number of these beats is grouped together to form a 'measure'. In much Western art music it is assumed that the first beat of the measure is the primary 'strong' beat, and that this strong beat is complemented by one or more subsidiary strong beats and weak beats. Metre is generally described by musicologists as a pattern of strong and weak beats, or as a grouping of beats for the purpose of measuring time. (4)

Metre for the Western musician and musicologist seems therefore to be a simple concept, a supposition which is confirmed by the brevity of entries on metre in music dictionaries such as the New Grove (Grove 6, 1980). Our purpose here is not to examine the concept of metre in Western music in great detail, (5) although we should note that not all musicologists accept this identity of metre with time signature. (6)

Without debating the concept of metre in Western art music much further, we can question the assumption of many ethnomusicologists that metre is indeed a simple concept which may

be applied to a wide range of musics, which may as a consequence be notated with Western-style time signatures. We do not dispute that time signatures may sometimes be appropriate to the description of non-Western music. What we do dispute however is that this may be assumed to be the case, without a close examination of the issues involved. The problems faced by ethnomusicologists in notating the rhythm of musics from around the world have been severe, even if many have remained unaware of them. (7) If in many cases the results have been unsatisfactory, the reason for this must be a failure to address the issues which are inevitably involved in adapting non-Western music to Western notational conventions. Within Western art music, although practice certainly varies between historical periods and between individual composers, it cannot be assumed that in all cases the time signature (notated metre) matches the metre perceived by all or most listeners. Ethnomusicologists should therefore be clear whether a time signature used in a transcription is intended to indicate perceived metre (and if so, that perceived by whom), or is being used simply to aid reading, without metrical significance.

Let us set aside apparently unmetered music or 'free rhythm' for the time being, (8) and consider here only music which appears to be clearly metered. If we wish to represent such rhythm in staff notation, then who decides which time unit is to be taken as the beat, and how to notate it? Who decides whether a grouping of 2, 3 or 4 beats is enough to specify a metre, or whether a higher level grouping (of 6, 8, 12 or 16 perhaps) is also metrically significant? Who decides where a measure begins and ends, and which pulse is a beat and which an 'off-beat'? All of these decisions may be significant in ethnomusicological transcriptions. Moreover, surely staff notation is profoundly influenced by the assumptions of a concept of metre originating in the West, for instance that the first beat of a measure is a primary 'strong' beat. Even something as basic as the assumption that notes are to be considered as *events occupying durations* (as is implicit in our notation system) as well as *events occurring at time points*may not be universally shared.

The problem of metre and its representation in ethnomusicology should be clear. Agawu (1995) makes a powerful counter-argument to this however: that in many cases scholars have on the contrary been *too reluctant* to assign time signatures to African music, instead either making unnecessarily complex polymetric transcriptions or insisting on the use of specially-designed notations which avoid the issue. (9) Agawu's argument is certainly persuasive to this extent - that where a strong case can be made for representing a particular metrical interpretation, the use of staff notation and a time signature may be the most efficient way of doing so. Even having taken this on board however - and without getting too deeply involved in ideological arguments on the hegemonic status of staff notation - practical problems still abound, because many pieces of music cannot easily be interpreted metrically, so that to represent them using conventional notational symbols will risk misleading the reader. In such cases the modification of, or indeed avoidance of, Western notational conventions should not simply be read as a kind of post-colonial exoticism.

There is clearly a need to sort out our concept of metre in such a way that we have definable and meaningful terms with which to describe a variety of musics, and notational tools

applicable to as many as possible. Three important strands of research have taken us part of the way to achieving this.

Firstly we are indebted to Kolinski, for making an important connection between metre and Gestalt psychology (1973). He described metre as a background against which the rhythmic surface is perceived. According to this view metre is a kind of reference grid which profoundly influences the perception and cognition of rhythm, the 'ground' to rhythm's 'figure'. (10) In most cases of course, metre must itself be inferred by the listener from the rhythmic surface. This suggests a complex mechanism in musical cognition, whereby metre is inferred subjectively from the rhythmic surface, which is itself then interpreted with reference to this very metrical framework.

Secondly Lerdahl and Jackendoff (1983), by attempting to disentangle metric and grouping structure in Western tonal music have been able to develop musicology's most convincing metric theory to date, although it is not yet clear to what extent this theory may be applicable to other musics. In this theory metre is described in terms of the interaction of two or more concurrent levels of pulsation, in such a way as to generate beats which are relatively strong or weak (the stronger beats being so in an abstract structural sense, not necessarily louder or more stressed than the weaker beats). A time point which is perceived as a beat on two different levels of pulsation is 'structurally stronger' than a point which is felt as a beat on only one level. For music to have metre therefore, it must be perceived to have at least two such pulse levels: often there will be three or more. This analysis and the dot notation used to illustrate it prove powerful tools in the metric analysis of Western tonal music, and may perhaps be adapted in other areas. (11)

Thus with Kolinski's image of metre as a cognitive background or framework for rhythm, and Lerdahl and Jackendoff's theory of its nature and system for its notation and analysis, we have the beginnings of a concept of metre of potentially wide applicability. This must however be seen in the light of a third, perhaps more radical approach still, that of Arom (1991). Arom suggests that although Central African polyrhythm is clearly organised in a periodic manner, the concept and term 'metre' are inappropriate in this context. Metre, as we have seen, implies a hierarchy of strong and weak beats. Central African polyrhythm on the other hand consists of a web of interlocking, periodic rhythmic patterns, organised around a single primary pulse level. Since there is only one pulse level, no hierarchy of beats and no 'beat one', this organisation cannot be described as metre.

Arom's clear sighted analysis provides us with another invaluable tool. Metre, as Lerdahl and Jackendoff and others (12) tell us, is a hierarchy of 'strong' and 'weak' beats against which rhythm is interpreted. But as Arom shows, rhythm can be organised in ways other than this - therefore either our concept of metre needs to be defined much more loosely, or as Arom proposes we must develop new concepts and new theories to describe non-metrical rhythmic organisation. Aroms work challenges us to develop more fundamental concepts of rhythmic organisation, but does not impel us to abandon the concept of metre. In fact we can further refine the concept of metre, unrestricted by the unreasonable assumption that it must apply to all music.

Many cultures have musical forms which appear not to be periodically organised (so-called 'free rhythm'). Moreover, as Arom has demonstrated, even periodically organised music cannot always be described in terms of metre - metre is clearly not a universal concept. We may however examine the possibility of a concept of metre which is applicable beyond our own culture, since the organisation of rhythm with respect to a periodic pattern of 'strong' and 'weak' beats is certainly not limited to the West. In order to do this we must appreciate the complexity of metre in musical performance and cognition. The first step towards this is the recognition that metre is above all a mental construct, an aspect of the cognitive representation of music.

Work in the cognitive psychology of music has begun to demonstrate the complexity of the relationship between sound wave and metre, between music sound and its cognitive representation. This shows that the construction of a cognitive representation of metre is far from being a simple process based on the recognition of louder sounds. Until we know more about how this reconstruction takes place, and how it differs according to the musical and cultural background of the listener, (13) we must admit our understanding of metre as a general phenomenon is incomplete. There is a great deal to be learned from future research, both within cognitive psychology and ethnomusicology. We need, however, to assess the state of our knowledge and to propose hypotheses to refine in the future. We believe the following seem at present to be reasonable working hypotheses on metre, which will serve as points of comparison with North Indian music.

1. Much music (but not all) is organised with respect to a periodic and hierarchical temporal framework, in such a way that a cognitive representation of this framework may be generated in the mind of the listener. This organisation and its representation are termed 'metre'.
2. Metre can be said to exist when two or more continuous streams of pulsation are perceived to interact; these streams are composed of time points (beats) separated by categorically equivalent time units. Time points which are perceived as beats on more than one level are stronger than those which are beats on only one level. The pattern of strong and weak beats generated in this way is both hierarchical and periodic.
3. The relationship between metre and rhythm has two major and complementary aspects: metre is inferred (partly or wholly subjectively) on the basis of the evidence presented by rhythm, (14) while rhythm is interpreted in terms of its relationship to that metre. (15)
4. The inference of metre is a complex phenomenon which is influenced by the musical experience and training of the listener, and more indirectly perhaps by his or her general experience and cultural background. Consequently both metric theory and practice are culturally determined to a great extent, although they are ultimately founded on the same psycho-physiological universals.

Tal: metre in North Indian music

The subject of tal is far too complex to be described here in full. Our intention is briefly to set out standard tal theory, together with some observations on the relationship between this theory and North Indian music as it is performed. This relationship may be summarised simply by saying that theory has played an important role in the development of practice, and indeed tal as currently practised could not have developed without the support of theory - yet it is equally true that the theory does not fully, or even in some cases adequately, describe that practice. The musical metre cannot be understood satisfactorily except through the theory of tal, and yet this theory can act as a distorting lens. In particular, it makes the musical tradition appear both more homogeneous, and more closely allied to historical precedent than it is in reality.

According to Indian musical theory, music may be either anibaddh (unbound, i.e. without tal) or nibaddh (bound, i.e. with tal). Nibaddh forms must be organised according to one or other authorised metrical structure or tal. Each of these tals (there are about 20 in common use in North Indian art music) is based on the interaction of three pulse levels, termed the matra (beat), avart (cycle) and vibhag (section). A certain number of matras, usually between 6 and 16, constitutes an avart or cycle, and this cycle is divided into two or more 'vibhags' or sections (which are not necessarily of equal length). Put another way, a number of vibhags each comprising several matras is added together to form an avart.

In jhaptal for example, each avart comprises 10 matras, organised into 4 vibhags of 2, 3, 2 and 3 matras respectively. This structure may be illustrated as follows:

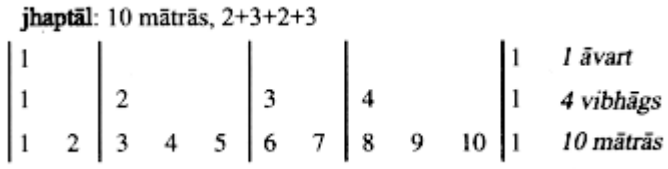

Figure 1: Jhaptal described in terms of three important pulse levels.

The structure of the tal may be indicated in performance, by performers and/or audience, using hand gestures on the first matra of each vibhag. There are two principal gestures: tali (a clap), indicated in notation by +, and khali (a wave), notated as 0. The first beat sam, despite its structural importance in the music, does not require its own special gesture (16) since it can be determined unambiguously from the asymmetrical nature of the clap pattern: musicians and musically-educated listeners know which of the gestures in the sequence represents sam.

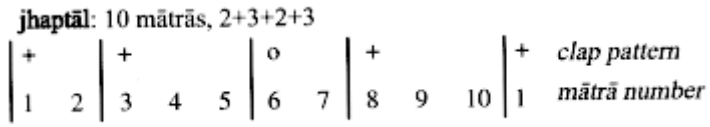

Figure 2: Jhaptal, showing the sequence of hand gestures (+=clap, 0=wave).

In addition to this cheironomic pattern, each tal has a basic sequence of drum strokes, called a theka, which partially defines the tal and is often the easiest means of identifying tals in practice.

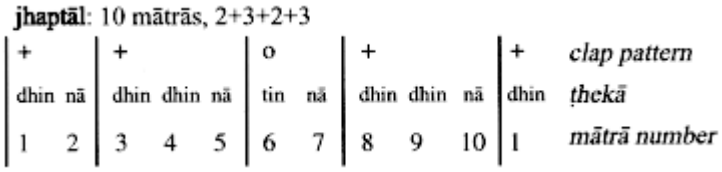

Figure 3: Jhaptal, showing both clap pattern and theka.

These two systems of tal definition, theka and clap pattern, exist side by side - although depending on the context, one may have much more practical importance than the other. In some tals, but not all, there exists a clear correlation between the structural implications of theka and clap pattern. This is the case in jhaptal, where the 'khali' gesture of the 3rd vibhag (matras 6-7) corresponds with the 'khali' or band bols (drum strokes with no bass resonance, represented by unvoiced syllables such as tin and na). This correlation is not always present however, and it is neither a requirement of theory, nor a practical necessity. The historical reasons for this complicated state of affairs are beyond the scope of this paper.

Other rhythmic terms supply further evidence regarding the conception of rhythmic organisation in North Indian music. Lay, for instance, is the closest equivalent of the western term 'tempo', (17) and its semantic field covers both the metric tempo (the primary pulse rate), the rhythmic density, (18) and the relationship between the two.(19) This threefold meaning has evolved due to changes in practice over the last 2,000 years. The original meaning of lay, in fact, is of the time interval between two beats, where beats were conceived as time points (potentially marked by actions) rather than as durations. Despite huge changes in both theory and practice, some features of Indian rhythm still make more sense if this conception of beats and notes occurring at points in time, rather than filling durations, is understood.

Another term, chand, can also be translated as 'metre', in a sense analogous to prosodic metre (indeed this is its primary meaning in Hindi). Used much less frequently than 'tal', chand refers principally to the rhythmic pattern characteristic of a tal (as articulated in the theka, in particular), especially when this rhythmic pattern is reproduced out of its original context. For instance, if the theka of jhaptal is played as a variation in a tabla solo in another tal (such as the 16 matra tintal), this may be referred to as playing in 'jhaptal chand'. (20)

These terms supply evidence of a multi-dimensional concept of metric organisation in North Indian music. Tal has two main aspects, one as an abstract temporal scheme manifested through clap patterns (cheironomy), the other as a repeated rhythmic pattern represented by a theka. Clap patterns manifest abstract temporal structures, enabling the listener to hear the rhythmic surface in the context of that framework - a concept strongly suggestive of Kolinski's idea of metre as the 'ground' for rhythm's 'figure'. Indeed this interpretation is supported by use of the term 'lay', which tells us that not only is there an ambiguity inherent in the concept of tempo (such as exists in the West), but also that the relationship between tal and surface

rhythm is accessible to conscious manipulation. The history of theoretical speculation on tal indicates that Indian musicians have long felt a clear conceptual separation between tal and rhythm.

However, use of the theka and of the term chand suggest that tal is not a wholly abstract phenomenon, since tals are associated with concrete rhythmic patterns which can be reproduced even outside their principal metrical context. This suggests that in reality, a tal is simply a repeated rhythmic pattern with parameters of stress, timing and drum timbre: something akin to the dynamic form described by Clynes and Walker. (21) Perhaps, as these writers suggest, this rhythmic form can be stored in the mind of the listener, who then expects the pattern to be repeated and compares the new rhythm with the expected pattern - which would suggest that knowledge of the theoretical section (vibhag) divisions is somewhat irrelevant.

This dual nature of tal, as both time-structure and stress-pattern, may correlate with another strand of research in music psychology. Bamberger suggests, on the basis of experiments with children, the existence of two modes of rhythmic understanding, termed figural and metrical. These modes are described as particular instances of a general dichotomy between "figural and formal modes of organizing present phenomena" (1991:15). According to this theory, metric understanding depends on the relationship of rhythm to an underlying beat, while figural understanding does not, relying more on general Gestalt principles such as the grouping of like elements. (22)

This work reminds us that even in cultures with advanced theories of metre, such as India, there are non-metrical ways to understand rhythm. In other words, it supports the notion that tals may be recognised on the basis of patterns of stress and/or timbre variation, irrespective of the numbers of time units involved which may help us to explain the similarities between the 16-matra tintal and its several variants, the 14-matra dipcandi, and the 10-matra jhaptal: each has the same + + 0 + clap pattern, and similar or identical sequences of tabla bols in its theka. (23) All this may therefore be taken as circumstantial evidence for the importance of the stress-pattern aspect of tal.

In reality then, tal can be conceived as either abstract or concrete. It is often both, hence the occasional correlation between clap pattern and theka - in these cases the theka adds an audible element to the abstract temporal scheme. In many contexts however, either the clap pattern or the theka predominates and the other is barely relevant.

Tal and metre compared: preliminary observations

How might tal be related to the theories of metre outlined above? We have already seen that tal appears to support Kolinski's Gestalt psychology-inspired idea, whether it is understood as abstract framework or even as a concrete rhythmic pattern. To this extent tal, it seems, is a special form of metre, a temporal framework acting as a background for rhythmic design. Lerdahl and Jackendoff's metric theory also seems to be applicable to tal, which can easily be analysed in terms of their theory. The one significant allowance we have to make in so doing, is for the possibility of the middle pulse level (the vibhag or section) being irregular, as it is in

jhaptal. If we take the matra as the highest metrically significant pulse level, the vibhag as the second and the avart as the third and lowest, we can apply Lerdahl and Jackendoff's notation as follows.

Pulses are represented by dots on three levels: points which are felt as pulses on three levels are structurally the strongest (sam); the next strongest are those felt as beats on two levels (matras 3, 6 and 8); the weakest beats are those felt on only one level (matras 2, 4, 5, 7, 9 and 10).

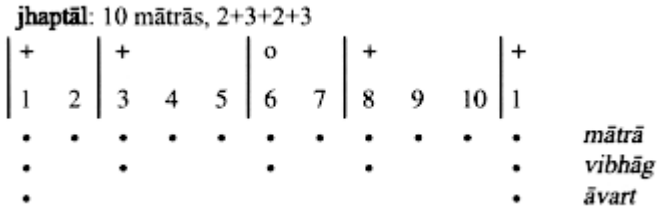

Figure 4: Jhaptal analysed according to Lerdahl and Jackendoff's metric theory.

Each tal has three distinct and interacting levels of pulsation, the matra, vibhag and avart. (Indeed, in the case of symmetrical tals such as jhaptal, in which the second half of the cycle is distinguished from the first half by the use of the khali gesture, there is a strong argument for including a fourth level as well, the half cycle. In the present article I have not done so, in order to keep the illustrations as simple as possible). Combining Lerdahl and Jackendoff's theory with Indian theory, we may state that the three pulse levels which define tal interact to form a consistent metric framework.

Comparing what we know about tal with our four working hypotheses on metre, we can make the following observations.

1. Tal is, like metre, a periodic and hierarchic temporal framework. We may reasonably assume that a cognitive representation of that framework may be constructed by a listener (depending on that listener's knowledge and experience).
2. Tal, like metre, involves the interaction of two or more streams of pulsation (in fact, usually at least three). One of these pulse levels may however be composed of a sequence of unequal time intervals. Beats on more than one pulse level are structurally important and are marked by hand gestures.
3. As with metre, rhythm in Indian music is interpreted with respect to tal. However the inference of tal may be less subjective than that of some other forms of metre, especially if the tal structure is clearly illustrated by clap patterns.
4. The inference of tal by musically uneducated listeners, assuming it can be inferred, would be at least as complex as with metre. In the case of musically literate listeners however, it can involve relatively simple procedures often simply the recognition of clap pattern and/or theka.

In general it appears that North Indian tal functions in many ways rather like metre in Western music, as a periodic, hierarchic framework for rhythmic design. There are two important respects in which tal differs from Western metre - that it may have an irregular intermediate pulse level, and that it is usually determined absolutely objectively by convention. The latter is not a clear distinction from Western music perhaps, but a difference of degree: jhaptal has 10 matras (and always 10, not a multiple or factor of 10), there can be no ambiguity as to the identity of the first beat sam, and so on. Audible and visible clues should ensure both that the listener cannot misinterpret the tal, and that no performer may lose track of the tal and inadvertently gain or lose beats (something which, while not unheard of, is in practice extremely rare even in very complex tals).

In comparison with many other metric systems, tal is peculiarly explicit. Tal is not simply an inherent quality of the music, to be inferred by the listener unaided. If this were the case listeners might find two or more metric interpretations of a single piece to be equally valid, an idea alien to Indian musical thought. In Indian music it is not uncommon for a musician to be employed primarily or even exclusively to keep tal (this applies to the tabla player himself in some genres of North Indian music). Singers count out the tal, members of the audience join them, and there is no choice or subjectivity involved in metric interpretation. The roots of this phenomenon, incidentally, lie in the ritual or quasi-ritual nature of early Indian music, although this is not the place to examine this point in detail.

The importance of tempo (lay) in determining metric structure

Let us return to our model of a tal framework comprising three or more pulse levels, acting as a reference matrix for surface rhythm. This model can be illustrated, with the aid of dot notation, as below. In Indian practice surface rhythm is not only interpreted by reference to tal, it is often generated directly from a subdivision of the matra pulse. Consequently in the figure below, this surface level is indicated by another row of dots.

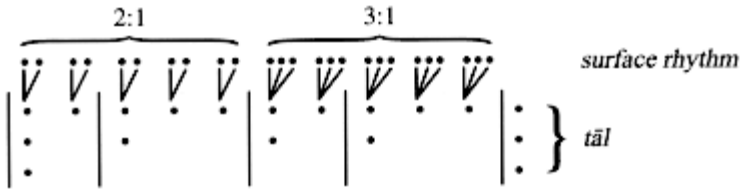

Figure 5: A model of tal as the interaction of three levels of pulsation, and of tals relationship to surface rhythm (again, using jhaptal).

This model works for much North Indian music, both vocal and instrumental, and where it does it proves a useful analytical tool. However, our research has thrown up several examples where it appears either not to apply, or to apply only with considerable modification. The key to understanding this appears to be tempo.

The model outlined above suggests quite well defined functions for the different pulse levels. The matra is the fastest metrically significant pulsation - the primary pulse rate, that which

defines tempo. The vibhags group the matras and assign functions to groups, turning a single pulse stream into a metre by making some matras 'stronger' than others the sequence of vibhags is what is counted out in the clap pattern. The avart is the slowest metrically significant pulsation - its significance is however generally rather different, in that it is the largest metrically significant *time unit* in the rhythmic organisation.

The functions of each level imply limits on the speed or rate of each pulse. In particular, if this model is assumed then the matra should be fast enough to be perceived as a connected stream of pulses, rather than as independent events, but slow enough to count out comfortably. We do not wish to set firm numerical limits here, but as a guide, many people would find Sachs's suggestion that the natural limits of tempo are 32-132MM (1953:33) roughly credible, if over-precise. Handel, on a more scientific basis, suggests that with intervals "beyond about 1.5 sec, two elements lose a sense of coherence and appear unrelated" (1989:389): this would imply a minimum figure for tempo of c. 40MM. The vibhag should also fall within these limits. The largest metrically significant time unit, on the other hand, should be accommodated within the perceptual present. If this hypothesis is correct, the cycle (avart) should occupy less than a probable limit of around 15 secs. (24)

We might predict that if pulse rates go far beyond these notional limits, that their function, and perhaps the whole fabric of the tal system, would be altered. But this is exactly what has happened in practice, and the consequences are just as might have been predicted.

Changes in the practice of Hindustani music over the last 150-200 years have resulted in the use of a very wide range of matra rates in performance: measured in matras per minute, the range would be from around 10MM to well over 700MM. (25) Not only may we speculate that this is too wide a range for tempo, but it also implies a range of cycle lengths from around 1.5secs to more than a minute. Thus the tempo range is too extreme at both ends for tal to function in practice as the model outlined above suggests it should - when very fast, the matra rate is too high to function metrically, when very slow the cycle is too long to be retained by the perceptual present (see Fig. 6).

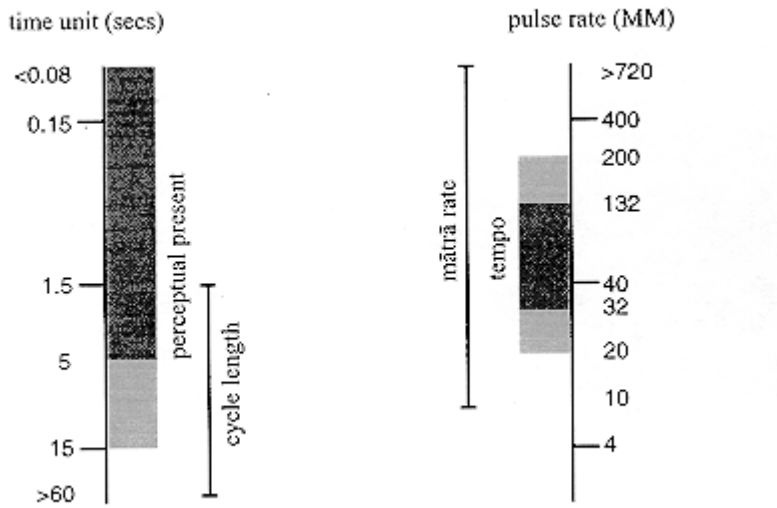

Figure 6: A comparison of (on the left) typical cycle (avart) lengths with the extent of the perceptual present; (on the right) typical matra rates with an estimated range for the pulse rate defining tempo.

In practice, what happens at very slow tempi is that the matra is too long to be regarded as the 'beat' - musicians count units of ½ or ¼ matra, and tabla players articulate these divisions when playing the theka. In effect, the ½ or ¼ matra pulse takes over the original role of the matra, and the matra takes over that of the vibhag (at very slow tempi clap patterns are rarely employed, which may make it easier for the function of the vibhag to be usurped). The vibhag cannot however be regarded as performing the function of the avart, since the importance of beat 1, 'sam', is retained in both composition and improvisation, and the theka moreover does not repeat at the vibhag level. The cycle retains a significance as a unit, but is divorced from the functional metric structure because the time span is much larger than the perceptual present. The structure of the metre is therefore distorted by the slow tempo as follows (Fig. 7).

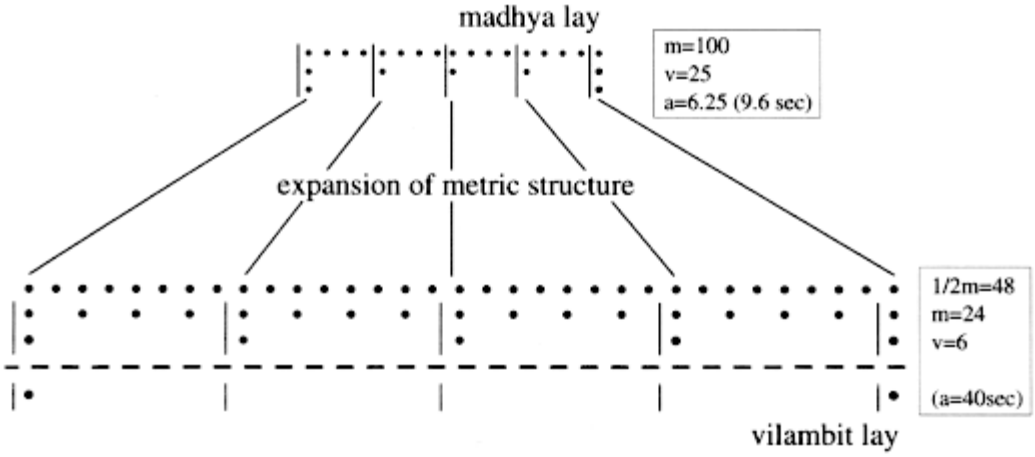

Figure 7: The expansion of the 16-matra tintal(26)**to a tempo of 24 matras/minute. m=matra, v=vibhag, a=avart; pulse rates are given in MM. The lowest level, the avart, becomes divorced from the metric structure at slow tempo (vilambit lay).**

The converse happens at very fast tempi: the matra now becomes identical with the surface rhythm level, since it approaches the maximum possible speed of the soloist's articulation and therefore cannot be subdivided - but it is now too fast (700MM+ at times) to be regarded as the primary pulse rate. The vibhag therefore now assumes the role of the primary pulse rate from the matra, but the vibhag is still used as such in the clap pattern and the avart is still the largest metrically significant time span (longer time spans than the avart rarely assume metrical significance in North Indian art music). The tal has effectively been simplified from a 3-level to a 2-level structure. (27)

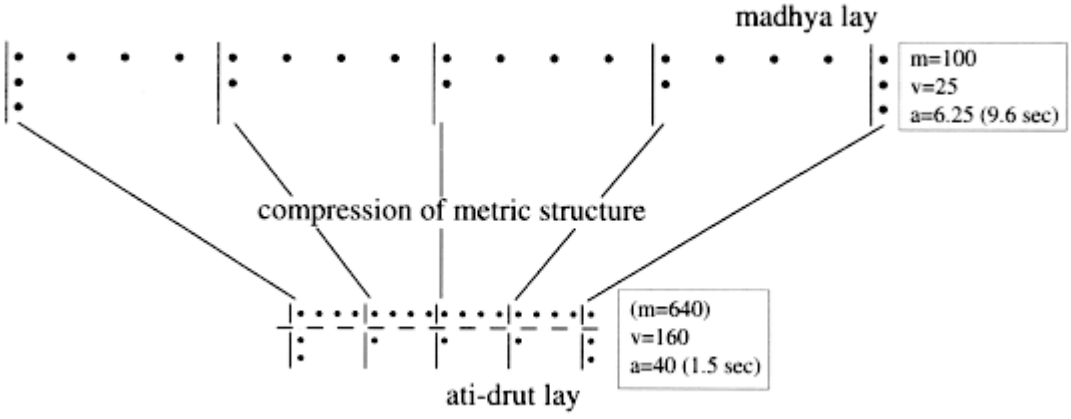

Figure 8: The compression of tintal at very high tempi. The highest level, the matra, loses its metrical function at very high tempo (ati-drut lay).

As indicated above this change in metric function has implications for the measurement of tempo in very slow tals the most appropriate measure of tempo becomes the ½ or ¼ matra pulse; in very fast tals it becomes a 2, 3 or 4 matra pulse. Even measured thus, the range of

tempi employed in North Indian music is wide, (28) perhaps as much as 20-180MM, and this may be possible because the highly developed nature of the tal system and its theory allows the representation of structures which might otherwise not have been appreciated because of the extreme tempi.

Metre in music without tal

The special nature of tal can be illustrated by reference to music with no tal (anibaddh). It is generally accepted that all such music is unmetered, ranging from the slow alap (said to be completely without pulse) to the jor, or madhya and drut alap (said to be pulsed but unmetered). However, just as Widdess questions whether alap is always strictly without pulse (1994), we suggest here that the view of jor as unmetered is also questionable. It is without tal for sure, but it may have metre in the general sense outlined above - in other words it does generate a hierarchic and periodic framework involving at least two pulse levels.

All jor has a regular pulse, and mostly it is organised around a simple 2, 4 or 8 beat pattern: in effect, it has two pulse levels and therefore fulfils at least Lerdahl and Jackendoff's conditions for metre. Jor of this kind cannot be said to have tal, since it is not organised by any authorised metric cycle. Moreover, since it is not set to a tal and usually not accompanied, the metre may be inconsistent. Beats may be lost or added from the binary scheme, the musician may change temporarily to a 3, 5 or 7 beat pattern, or take a break in singing or playing without retaining the binary 'metre' in his/her mind. This irregularity is no more notable than in many other musics which are considered metrical, yet it is very irregular by the standards of tal.

In some cases the metre of jor can become more elaborate. Some musicians take, for example, two 4-beat patterns to be one integral unit. This is true for instance of sitarist Deepak Choudhury, who claims to keep such a structure in mind when playing jor, and encourages his disciples to 'count time' for his jor, marking the 4-beat patterns with an alternation of claps and waves (tali and khali). Several other musicians, including Pandit Ravi Shankar, have played jor in a strict 8-beat 'tal', accompanied by a pakhavaj or a kharaj (bass) tabla: this is said to be a traditional practice. (29) It is notable that although such music may fulfil the necessary conditions for the existence of metre, it does not fulfil the more stringent requirements of tal, which confirms the view expressed above that tal is a more specific concept than metre.

Tal and metre - a summary

The comparison of the concepts of metre and tal tells us something about both. We started with a dual model of metre, as both the interaction of two or more pulse levels (which replaces an earlier, but more problematic, idea of metre as an alternation of strong and weak beats), and a background for rhythmic design. These two aspects apply without doubt to North Indian music, both in all tal-bound forms and in a great deal of music without tal. Tal itself however requires more stringent conditions to be fulfilled.

1. Tal is an explicit dimension of the music which must be established unambiguously.
2. Rhythm should be organised according to one or other authorised metrical pattern or tal.
3. These tals are temporal structures defining at least three (not two) levels of pulsation.

The definition of beats within the tal cycle as strong and weak would be problematic here, inasmuch as it might imply that strong beats are dynamically accented, i.e. louder than the rest. In fact, in Indian music dynamic accents may fall on any beat (or indeed inbetween). What tal provides is a matrix of structurally important beats, which occur where pulse streams coincide on two or more levels: these pulses do not have to be accented but may be inferred on the basis of, for example, changes in drum timbre or composition structure.

North Indian music also provides the clearest possible endorsement of Kolinski's view, in that Indian musicians clearly separate rhythm and metre conceptually in a manner analogous to figure and ground in Gestalt psychology. Metre (tal) is an abstract framework primarily constructed in the mind of the performer and represented by a clap pattern and/or a theka, from which it may in turn be reconstructed by a listener. Rhythm is understood in the context of this framework, and although it may often be generated directly from the tal it remains separate from it.

There are some problems with this separation however. For instance, the theka is a rhythmic pattern used to represent a metre - since it holds this function, it comes to be identified with the metre. Thus both the separation of rhythm and tal and the abstract nature of the latter may be compromised by the use of the theka. It is common in many musical traditions for metre to be defined by a repeated rhythmic pattern, and for the performers of such music, metre without rhythm is unlikely to be a meaningful concept. (This intimacy also causes much theoretical confusion, to the extent that in some musicological works the distinction between rhythm and metre is drawn loosely if at all.)

This study also reminds us of the crucial importance of tempo in the functioning of metre. Metre is formed by the interaction of pulse levels, and it is probable that these pulse levels may be assigned certain functions in the cognitive representation of metre. Metres can be accelerated or decelerated, but if tempo is changed beyond certain limits (and we can only guess at present what these might be) then the functioning of metre must be disturbed. The function of individual pulse levels, as we have seen, may change, and pulse levels may become metrically obsolete or new levels come into play.

A third area where Indian music can assist our speculation on metre is in the importance of theory: the North Indian metric system clearly could not exist in its present form, if it were not for the contribution of theory to the development of practice, nor could many of the complex metric structures be intuited by listeners who had no access to that same theory. Thus theory is not only something which describes tal, and imperfectly at that, it is part of the very fabric of tal and cannot be dissociated from its practice. Theory plays a role in assisting the cognitive representation of complex structures, and creates possibilities for developments in practice.

This study shows that there are many similarities between the concept of metre as understood by Western musicologists, and that of tal as developed in India. The differences - the use of irregular pulse levels in India, the insistence on three or more pulse levels and the peculiarly explicit nature of tal are important. But compared to the fundamental similarities between the two concepts they are relatively superficial. This is an important observation because it suggests that while metre is not a factor in all music, neither is it restricted to the West. We believe that observations of Indian music allow our concept of metre to be seen in a different and helpful perspective, and vice versa.

References

Agawu, Kofi

1995 *African rhythm. A Northern Ewe perspective*. Cambridge: Cambridge University Press

Arom, Simha

1991 *African polyphony and polyrhythm.* (trans. M. Thom, B. Tuckett, R. Boyd) Cambridge: Cambridge University Press.

Bamberger, Jeanne

1991 *The mind behind the musical ear. How chilren develop musical intelligence*. Cambridge, Mass.: Harvard University Press.

Berry, Wallace

1976 *Structural functions in music*. Englewood Cliffs: Prentice-Hall.

Clayton, Martin R. L.

1993a *The rhythmic organisation of North Indian classical music: tal, lay and laykari.* Unpub. PhD diss., SOAS, University of London.

1993b "Two gat forms for the sitar: a case study in the rhythmic analysis of North Indian music". *British Journal of Ethnomusicology* 2, pp.75-98.

1996 "Free rhythm: ethnomusicology and the study of music without metre" *Bulletin of SOAS*. LIX/2, pp.323-332.

Clynes, Manfred and Janice Walker

1982 "Neurobiologic functions of rhythm, time and pulse in music" in Clynes, M (ed.) *Music, Mind and Brain.* pp. 171-216 New York: Plenum Press.

Cooper, Grosvenor & Leonard B Meyer

1960 *The rhythmic structure of music*. Chicago: University of Chicago Press.

Dowling, W Jay and Harwood, Dane L

1986 *Music cognition*. London: Academic Press.

Gottlieb, Robert

1993 *Solo tabla drumming of North India: its repertoires, styles and performance practices.* (2 vols). Delhi: Motilal Banarsidass.

Grove 6

1980 *The New Grove dictionary of music and musicians.* ed. Stanley Sadie London: Macmillan.

Handel, Stephen

1989 *Listening: an introduction to the perception of auditory events.* Cambridge, Mass.: MIT Press.

Hopkins, Pandora

1982 "Aural thinking" in R. Falck and T. Rice (eds) *Cross cultural perspectives on music.* Toronto: University of Toronto Press.

Kippen, James R

1988 *The tabla of Lucknow: a cultural analysis of a musical tradition*. Cambridge: Cambridge University Press.

Kolinski, Mieczyslaw

1959 "The evaluation of tempo" *Ethnomusicology* 3/2:45-57.

1973 "A cross-cultural approach to metro-rhythmic patterns" *Ethnomusicology* 17/3:494- 506.

Lerdahl, Fred and Ray Jackendoff

1983 *A generative theory of tonal music.* Cambridge, Mass.: MIT Press.

Manuel, Peter

1983 "The concept of Tala in semi-classical music". *National Centre for the Performing Arts Quarterly Journal* (Bombay) 12/4:7-14.

Pantaleoni, Hewitt

1987 "One of Densmore's Dakota rhythms reconsidered" *Ethnomusicology* 31/1: 35-55.

Rowell, Lewis

1988 "Form in the ritual theatre music of ancient India" in *Musica Asiatica* 5 Cambridge: Cambridge University Press.

Sachs, Curt

1953 *Rhythm and Tempo.* London: Dent.

Smith, K. C., L. L. Cuddy and R. Upitis

1994 "Figural and metric understanding of rhythm". *Psychology of Music* 22:117-135.

Vos, P. G.

1979 *Identification of metre in music.* (Internal Report 0N07). Nijmegen: University of Nijmegen.

Walker, Robert

1992 Review of Bamberger 1991. *Psychology of Music* 20:186-191

Widdess, Richard

1994 "Involving the performers in transcription and analysis: a collaborative approach to dhrupad" *Ethnomusicology* 38/1:59-80.

Windsor, W. Luke

1993 "Dynamic accents and the categorical perception of metre" *Psychology of Music* 21: 127-140.

Yeston, Maury

1976 *The stratification of musical rhythm*. New Haven, Conn.: Yale University Press.

Notes

(1) Clayton 1993a (parts summarized in 1993b). This work is to be published, in revised form, by Oxford University Press.

(2) I would like to thank Dr Richard Widdess and Dr Ian Cross for their comments on earlier drafts of this paper.

(3) In fact, the notion of 'beat' is somewhat ambiguous, referring to both a time unit and a time point (and, indeed, an action occurring at a time point).

(4) See e.g. Cooper and Meyer (1960:4), who stress the former; Grove 6 (1980, vol 12:222) which stresses the latter; and the more sophisticated definitions given by Yeston (1976:32-3) and Lerdahl and Jackendoff (1983:12).

(5) As a number of musicologists have begun to do - see Lerdahl and Jackendoff, Yeston etc.

(6) For instance, Berry suggests that "It is fundamental that the meter is often independent of the notated bar-line", and that an important aspect of metrical analysis is the determination of the "real" metre, whether or not it accords with the notated metre (1976:324).

(7) Ethnomusicologists who have written on these difficulties include Kolinski (1973), Pantaleoni (1987) and Arom (1991).

(8) For a discussion of, and select bibliography on free rhythm, see Clayton 1996.

(9) See e.g. Agawu 1995:185ff.

(10) See also Dowling and Harwood 1986:186.

(11) See Clayton 1993:144ff.

(12) See e.g. Yeston 1976:32-3.

(13) The subjectivity of metric interpretation in practice is demonstrated in different ways by both Hopkins (1982) and by Vos (1979, cited by Handel 1989:411ff). This is a subject worthy of further enquiry, however.

(14) Rhythm is used here in its general sense as the arrangement of musical elements in time.

(15) See e.g. Windsor 1993 for a discussion of the interdependence of dynamic accents and metric structure.

(16) Sam does have its own notational sign however, X. Notational conventions vary: talis, for instance, may be indicated by numerals rather than simply '+'.

(17) Lay is also the term used by Indian writers as the closest equivalent of 'rhythm' itself.

(18) The rate at which rhythmic events occur: 'tempo' in the sense suggested by Kolinski in his 1957 paper.

(19) Rowell writes that laya in ancient Indian theory represented "neither the rate of pulsation not the rate of eventfulness as recognized in the West; it is more accurate to think of it as the rate of structural succession, as measured and regulated by the underlying gesture patterns" (1988:150). As used by modern day Hindustani musicians, lay may refer to any of these concepts.

(20) See Kippen (1988:169-170) and Gottlieb (1993: vol1 p.133, vol2. p.140).

(21) Clynes and Walker write of the "replication of a single dynamic form stored in memory" (1982:176). This concept seems appropriate to tals, when supported in practice by a drum pattern repeated with little or no variation.

(22) Elements of Bamberger's theory have been contested - significantly, in this case, her work has been criticized for a lack of cultural perspective (see Walker, 1992). The significance she attributes to figural and metric modes of rhythmic understanding is however our concern here our point is that there may be a correlation between the dual nature of rhythmic understanding posited by Bamberger (and developed further by others such as Smith, Cuddy and Upitis 1994) and that of tal (as described here).

(23) Manuel describes the relationships between these tals in more detail, noting also that tal names such as dipcandi, cancar and addha may refer to structures of either 14 or 16 beats (1983).

(24) Cognitive psychologists do not specify an absolute maximum for this perceptual or psychological present (which is thought to correspond closely with the limit of working memory). In normal circumstances it is believed to lie in the range 2- 5 seconds, although it is recognised that under certain conditions this may be increased. Even then, however, it is extremely unlikely to extend beyond about 12-15 seconds. (Dowling and Harwood 1986:179-181; Dr. Ian Cross, pers. com.)

(25) Very slow tempi have come to be used in the bara khyal vocal form in particular, and very fast tempi primarily in instrumental music, with much of the change occuring during this century. The fact that these developments have been relatively recent supports a view that the model of tal outlined above is historically predominant, with recent developments distorting its function.

(26) One cycle of tintal comprises 16 matras, divided into 4 vibhags of 4 matras each.

(27) Or from 4 to 3 levels, if the half-cycle level is treated as metrically significant.

(28) In comparison with Sachs's suggestion: see footnote above.

(29) Deepak Choudhury (pers. com.). Some dhrupad singers also adopt this practice, while rudra vina players sometimes have their pakhavaj (barrel-drum) player play the 12-matra cautal during the jor section (Dr R. Widdess, pers. com.).